BA

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : G02B 6/245 — A1

(11) International Publication Number: WO 00/28359

(43) International Publication Date: 18 May 2000 (18.05.00)

(21) International Application Number: PCT/US99/20301

(22) International Filing Date: 3 September 1999 (03.09.99)

(30) Priority Data:
09/189,380 9 November 1998 (09.11.98) US

(71) Applicant: HONEYWELL INC. [US/US]; Honeywell Plaza, Minneapolis, MN 55408 (US).

(72) Inventors: FETH, John, R.; 1930 East Claire Drive, Phoenix, AZ 85022 (US). NIEMEYER, Richard, L.; 10029 Burnett Road, Peoria, AZ (US).

(74) Agent: KAU, Albert, K.; Honeywell Inc., Honeywell Plaza – MN12–8251, P.O. Box 524, Minneapolis, MN 55440–0524 (US).

(81) Designated States: BR, CA, JP, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: METHOD OF PREPARING OPTICAL FIBER FOR FUSION SPLICING

(57) Abstract

A method of preparing an optical fiber for fusion splicing comprising the steps of providing an optical fiber having a fiber jacket and an end, removing a predetermined bulk of the fiber jacket from an area adjacent the end while one of substantially simultaneously moving gas over the area and exhausting gas from the area in order to clean the optical fiber. Preferably the fiber jacket is removed by cutting with laser beam. The fiber end is ablated to create a smooth surface normal to the fiber's longitudinal axis.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

METHOD OF PREPARING OPTICAL FIBER FOR FUSION SPLICING

TECHNICAL FIELD

This invention relates generally to the field of optical fiber technology and, more particularly, to a method of preparing optical fiber for fusion splicing and a method of forming a fusion splice.

BACKGROUND ART

Optical fibers used in sensors and other optical circuits that use concatenated segments require stable alignments between the segments to ensure and maintain exemplary circuit performance. Fusion splicing, a controlled heating and joining of the segment ends, provides this stability in the x, y, and z dimensions and in rotational azimuth around the fiber axis.

Preparation for fusion splicing currently involves the use of mechanical or chemical methods to strip the protective jacket from the end of each optical fiber segment, and to clean the stripped optical fiber ends of residue in preparation for forming a smooth surface, such as with a mechanical cleave, at each optical fiber segment. The foregoing operation is not only tedious, time consuming and substantially normally carried out only by hand, but can also occasion damage to the optical fiber segments which can materially reduce the quality and lifetime of the fusion splice.

Accordingly, it would be highly desirable to provide an improved method of preparing optical fiber for fusion splicing.

It is a purpose of the present invention to provide a new and improved method of preparing optical fiber for fusion splicing that is easy to implement.

It is another purpose of the present invention to provide a new and improved method of preparing optical fiber for fusion splicing that is reliable.

It is still another purpose of the present invention to provide a new and improved method of preparing optical fiber for fusion splicing that produces a high quality, rugged and long-lasting fusion splice.

It is a further purpose of the present invention to provide a new and improved method of preparing optical fiber for fusion splicing that is efficient and inexpensive.

It is still a further purpose of the present invention to provide a new and improved method of preparing optical fiber for fusion splicing that substantially eliminates optical fiber contamination.

It is yet still a further purpose of the present invention to provide a new and improved method of fusion splicing segments of optical fiber.

It is another purpose of the present invention to provide a new and improved method of forming a fusion splice.

It is yet another purpose of the present invention to provide a new and improved method of forming a fusion splice that utilizes no touch labor.

DISCLOSURE OF THE INVENTION

The above problems and others are at least partially solved and the above purposes and others are realized in a new and improved method of preparing optical fiber for fusion splicing, a new and improved method of fusion splicing segments of optical fiber and a new and improved method of forming a fusion splice.

In a specific embodiment, an exemplary method of preparing an optical fiber for fusion splicing may generally comprise the steps of providing an optical fiber having a fiber jacket and an end, removing a predetermined bulk of the fiber jacket from an area adjacent the end while substantially simultaneously cleaning the area by one of moving gas, such as by pulsing, over the area and exhausting gas from the area. The step of removing a predetermined bulk of the fiber jacket from an area adjacent the end may further include the step of directing a cutting beam against the fiber jacket and one of the steps of moving the cutting beam over the area and moving the optical fiber through the cutting beam. Moving the optical fiber through the cutting beam may include at least one of the steps of rotating the optical fiber through the cutting beam and translating the optical fiber through the cutting beam substantially along one of an x-axis, a y-axis and a z-axis. To complete preparation of the optical fiber for fusion splicing, the method may further include the step of ablating the end of the optical fiber substantially normal to its x-axis.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and further and more specific objects and advantages of the instant invention will become readily apparent to those skilled in the art from the following detailed description thereof taken in conjunction with the drawings in which:

Fig. 1 illustrates a schematic representation of a system for preparing fiber for fusion splicing;

Fig. 2 illustrates a side sectional view of a fiber having a segment stripped of its jacket or coating;

Fig. 3 illustrates a side view of two opposing fibers each having a segment stripped of its jacket or coating; and

Fig. 4 illustrates a side view of the segments Fig. 4 shown as they would appear joined by fusion.

BEST MODE FOR CARRYING OUT THE INVENTION

The present invention provides, among other things, a new and improved method of preparing optical fiber for fusion splicing, a new and improved method of fusion splicing segments of optical fiber and a new and improved method of forming a fusion splice. Ensuing embodiments of the present invention are easy and inexpensive to carry out, substantially eliminate fiber optic segment contamination and occasion a long-lasting and rugged fusion splice.

Turning now to the drawings, in which like reference characters indicate corresponding elements throughout the several views, attention is directed to Fig. 1 which illustrates a schematic representation of a system 10 for preparing an optical fiber 11 for fusion splicing, optical fiber 11 including a fiber cladding 12 encapsulated in a fiber jacket or coating 13 as shown substantially in Fig. 2. System 10 is generally comprised of a fixture 14, such as a chuck or the like, cutting apparatus 15 for cutting away portions of fiber jacket 13 at, for instance, an area 16 adjacent an end 17 of optical fiber 10, and a gas source 18 for moving gas over area 16. The gas provided from gas source 18 may be air, a selected inert gas, etc. Furthermore, the gas provided from gas 18 may be delivered to area 16 in one of a continuous stream of gas and pulses of gas if desired. Rather than move gas over area 16 during the process, gas may otherwise be exhausted from the work area with a vacuum apparatus. In this regard, gas source 18 could be provided as a vacuum apparatus.

In a preferred embodiment, cutting apparatus 15 includes an optical system that delivers a laser or cutting beam 20 focused on or against fiber jacket 13, although more than one cutting beam 20 may be used. Beam 20 includes sufficient power density to cut away or ablate fiber jacket 13. In this vein, fixture 14 is operative receiving and holding and, if desired, moving optical fiber 11 into and through beam 20 for one or more of rotation about its x-axis, translation substantially along the x-axis, translation substantially along a y-axis and translation substantially along a z-axis as needed for

carrying out a desired cutting operation or otherwise so that beam 20 may operate to remove a predetermined bulk of fiber jacket 13 from fiber cladding 12 to form a segment 21 of exposed fiber cladding 12 as evinced in Fig. 2. Cleaning fiber cladding 12 of residual fiber jacket 13 residue may be accomplished in substantially the same manner as normal cutting operations and by adjusting the power density, wavelength and focus of beam 20 as needed. Additionally, although fiber 11 may be rotated and translated through beam 20 by fixture 14 as needed during the foregoing cutting operation, it may alternatively be held stationary and cutting apparatus 15 rotated and translated over area 16 if so desired.

Cutting apparatus 15 may alternatively be provided as a system including an apparatus for delivering a scanned and focused carbon dioxide laser beam having, for instance, a 10.6 micron wavelength, to remove fiber jacket 13.

During or otherwise substantially simultaneously with the cutting away of a predetermined bulk of fiber jacket 13 with cutting apparatus 15, gas source 18 operates to move or flood air, such as by pulsing, generally over area 16 at the focus point of beam 20 to clean or blow away fiber jacket 13 residue removed during the cutting process. Cleaning of area 16 with gas delivery is important for keeping area 16 clear of unwanted debris during the cutting process and serves as a highly efficient method of cleaning and of substantially reducing fiber cladding 12 contamination. This cleaning process may also be carried out by exhausting gas away from area 16.

To complete the preparation of optical fiber 11 for fusion splicing after a predetermined bulk of fiber jacket 13 has been removed to form segment 21 of exposed fiber cladding 12, a portion of segment 21 at or adjacent end 17 is ablated as fixture 14 rotates and translates optical fiber 11 through beam 20 to create a smooth surface substantially square or normal to its x-axis. However, this smooth surface could also be created by a diamond wheel cutter for cleaving portions of the exposed fiber cladding 12. During this ablating step, air may be moved by gas source 18, such as by pulsing, over the ablated area to keep system 10 and optical fiber 11 free of debris. However, optical fiber 11 may be kept free of debris by exhausting air from the ablated area. Although optical fiber 12 may be rotated by fixture 14 during the foregoing ablation operation, it may alternatively be held stationary and cutting apparatus 15 rotated and translated relative optical fiber 11 if so desired. Furthermore, and as previously intimated, a plurality of beams may be incorporated in the foregoing process if so desired.

With fiber 10 prepared in the foregoing manner and ready for fusion splicing as

shown in Fig. 3, a second optical fiber 30 may be prepared in substantially the same manner, optical fiber 30 shown having a fiber cladding 31, a fiber jacket 32, an area 33 defining a segment 34 of exposed fiber cladding 31 and an end 35. It should be readily understood that optical fiber 30 includes x-, y- and z- axes as shown in Fig. 3. Ends 17 and 35 of optical fibers 11 and 30, respectively, may then be spatially and, if necessary, azimuthally aligned as shown for a fusion splicing operation each using, for instance, the translation and rotation capabilities of a fixture such as fixture 14. So aligned, ends 17 and 35 may be fusion spliced together as shown in Fig. 4 by a conventional fusion splice operation to form a fusion splice 40. Those having regard toward the relevant art will readily appreciate that upon completion of fusion splice 40, segments 21 and 34 may be re-jacketed with fiber jacket material if so desired.

The present invention has been described above with reference to a preferred embodiment. However, those skilled in the art will recognize that changes and modifications may be made in the described embodiments without departing from the nature and scope of the present invention. Various changes and modifications to the embodiment herein chosen for purposes of illustration will readily occur to those skilled in the art. To the extent that such modifications and variations do not depart from the spirit of the invention, they are intended to be included within the scope thereof, which is assessed only by a fair interpretation of the following claims.

Having fully described the invention in such clear and concise terms as to enable those skilled in the art to understand and practice the same, the invention claimed is:

CLAIMS

1. A method of forming a fusion splice, comprising the steps of:

providing a first optical fiber having a first fiber jacket and a first end, and a second optical fiber having a second fiber jacket and a second end;

removing a predetermined bulk of the first fiber jacket from a first area adjacent the first end;

substantially simultaneously cleaning the first area;

removing a predetermined bulk of the second fiber jacket from a second area adjacent the second end;

substantially simultaneously cleaning the second area;

aligning the first end with the second end; and

fusing the first end with the second end.

2. The method of claim 1, wherein the step of removing a predetermined bulk of the first fiber jacket from a first area adjacent the first end further includes the step of directing one or more cutting beams against the first fiber jacket.

3. The method of claim 2, wherein the step of directing one or more cutting beams against the first fiber jacket further includes the step of moving the one or more cutting beams over the first area.

4. The method of claim 1, wherein the step of removing a predetermined bulk of the first fiber jacket from a first area adjacent the first end further includes the steps of:

directing one or more cuttings beam against the first fiber jacket; and

moving the first optical fiber through the one or more cutting beams.

5. The method of claim 4, wherein the step of moving the first optical fiber through the one or more one or more cutting beams further includes the step of rotating the first optical fiber through the one or more one or more cutting beams.

6. The method of claim 5, wherein the step of rotating the first optical fiber through the one or more cutting beams further includes the steps of:

mounting the first optical fiber with a fixture; and

rotating the fixture.

7. The method of claim 4, wherein the step of moving the first optical fiber through the one or more cutting beams further includes the step of translating the first optical fiber through the one or more cutting beams.

8. The method of claim 7, wherein the step of translating the first optical fiber through the one or more cutting beams further includes the steps of:

mounting the first optical fiber with a fixture; and

translating the fixture substantially along one or more of an x-axis, a y-axis and a z-axis.

9. The method of claim 1,

the first optical fiber further including an axis,

wherein the step of removing a predetermined bulk of the first fiber jacket from a first area adjacent the first end further includes the step of ablating the first end substantially normal to the axis.

10. The method of claim 1, wherein the step of removing a predetermined bulk of the second fiber jacket from a second area adjacent the second end further includes the step of directing one or more cutting beams against the second fiber jacket.

11. The method of claim 10, wherein the step of directing one or more cutting beams against the second fiber jacket further includes the step of moving the one or more cutting beams over the second area.

12. The method of claim 10, wherein the step of removing a predetermined bulk of the second fiber jacket from a second area adjacent the second end further includes the steps of:

directing one or more cutting beams against the second fiber jacket; and

moving the second optical fiber through the one or more cutting beams.

13. The method of claim 12, wherein the step of moving the second optical

fiber through the one or more cutting beams further includes the step of rotating the second optical fiber through the one or more cutting beams.

14. The method of claim 13, wherein the step of rotating the second optical fiber through the one or more cutting beams further includes the steps of:

mounting the second optical fiber with a fixture; and

rotating the fixture.

15. The method of claim 12, wherein the step of moving the second optical fiber through the one or more cutting beams further includes the step of translating the second optical fiber through the one or more cutting beams.

16. The method of claim 15, wherein the step of translating the second optical fiber through the one or more cutting beams further includes the steps of:

mounting the second optical fiber with a fixture; and

translating the fixture substantially along one or more of an x-axis, a y-axis and a z-axis.

17. The method of claim 10, the second optical fiber further including an axis, wherein the step of removing a predetermined bulk of the second fiber jacket from a second area adjacent the second end further includes the step of ablating the second end substantially normal to the axis.

18. The method of claim 1, wherein the step of substantially simultaneously cleaning the first area further includes at least one of the steps of substantially simultaneously moving gas over the first area and exhausting gas from the first area.

19. The method of claim 1, wherein the step of substantially simultaneously cleaning the second area further includes at least one of the steps of substantially simultaneously moving gas over the first area and exhausting gas from the first area.

20. A method of preparing an optical fiber for fusion splicing, comprising the steps of:

providing an optical fiber having a fiber jacket and an end;

removing a predetermined bulk of the fiber jacket from an area adjacent the end; and

substantially simultaneously cleaning the area.

21. The method of claim 20, wherein the step of removing a predetermined bulk of the fiber jacket from an area adjacent the end further includes the step of directing one or more cutting beams against the fiber jacket.

22. The method of claim 21, wherein the step of directing one or more cutting beams against the fiber jacket further includes the step of moving the one or more cutting beams over the area.

23. The method of claim 20, wherein the step of removing a predetermined bulk of the fiber jacket from an area adjacent the end further includes the steps of:

directing one or more cutting beams against the fiber jacket; and

moving the optical fiber through the one or more cutting beams.

24. The method of claim 23, wherein the step of moving the optical fiber through the one or more cutting beams further includes the step of rotating the optical fiber through the one or more cutting beams.

25. The method of claim 24, wherein the step of rotating the optical fiber through the one or more cutting beams further includes the steps of:

mounting the optical fiber with a fixture; and

rotating the fixture.

26. The method of claim 23, wherein the step of moving the optical fiber through the one or more cutting beams further includes the step of translating the optical fiber through the one or more cutting beams.

27. The method of claim 26, wherein the step of translating the optical fiber through the one or more cutting beams further includes the steps of:

mounting the optical fiber with a fixture; and

translating the fixture substantially along one or more of an x-axis, a y-

axis and a z-axis.

28. The method of claim 20, the optical fiber further including an axis, wherein the step of removing a predetermined bulk of the fiber jacket from an area adjacent the end further includes the step of ablating the end substantially normal to the axis.

29. The method of claim 20, wherein the step of substantially simultaneously cleaning the area further includes at least one of the steps of substantially simultaneously moving gas over the area and exhausting gas from the area.

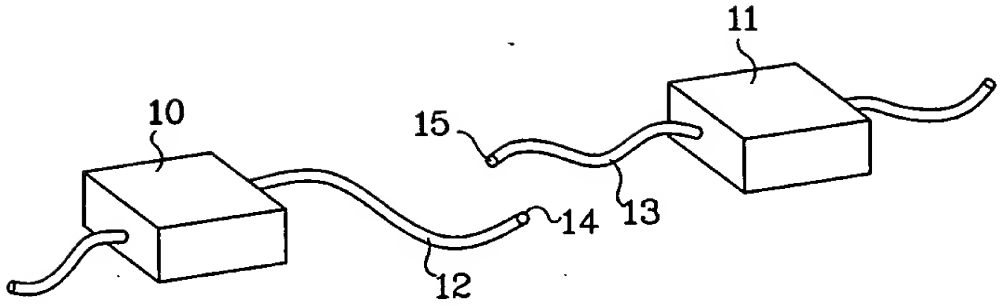

Fig.1

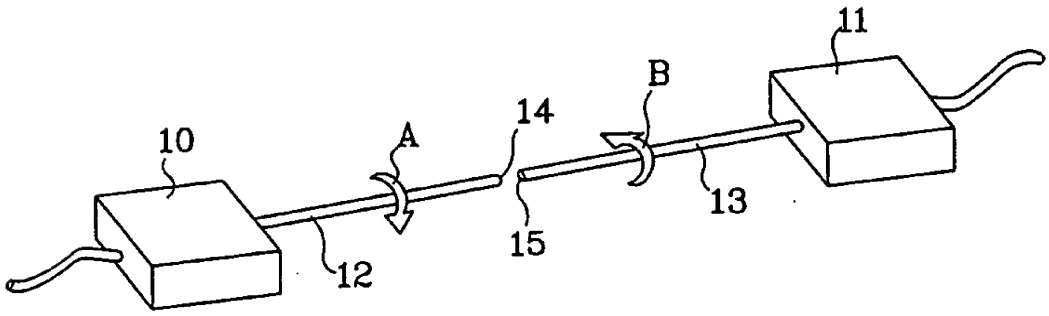

Fig.2

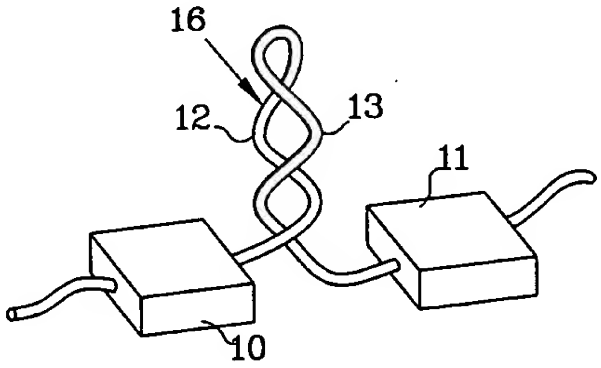

Fig.3

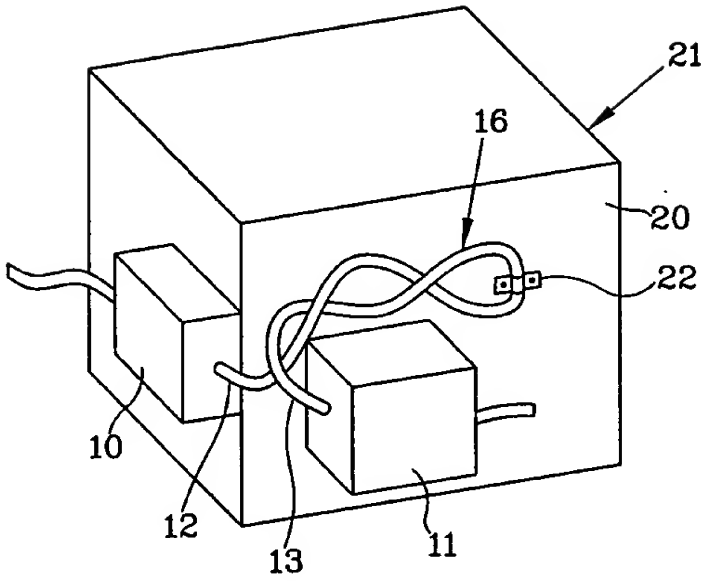

Fig.4

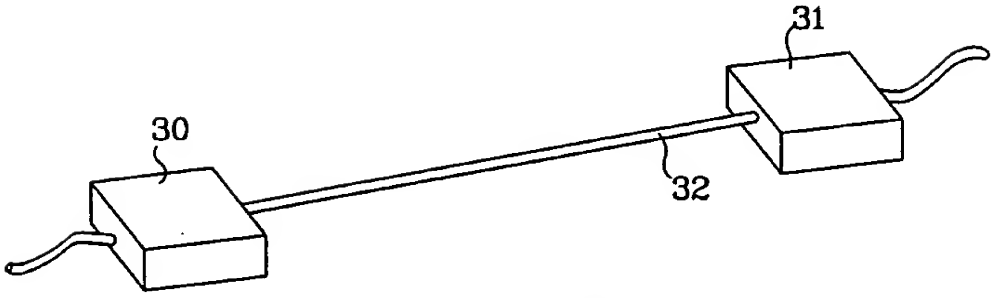

Fig.5

INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/US 99/20301

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G02B6/245

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G02B C03B B23K C03C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 41 40 087 A (KABELMETAL ELECTRO GMBH) 9 June 1993 (1993-06-09) column 2, line 20 -column 3, line 8; figure 1	1-8, 10-16, 18-27,29
X	PATENT ABSTRACTS OF JAPAN vol. 017, no. 161 (P-1512), 29 March 1993 (1993-03-29) & JP 04 324403 A (FUJITSU LTD), 13 November 1992 (1992-11-13)	20-22,29
A	abstract	1-3,10, 11,18,19
X	DE 37 18 402 A (CERAM OPTEC DR NEUBERGER KG) 22 December 1988 (1988-12-22) column 2, line 49 -column 3, line 11 column 3, line 35 - line 38	20,21,29

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 February 2000	01/03/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ciarrocca, M

2

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/20301

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 018, no. 162 (P-1712), 17 March 1994 (1994-03-17) & JP 05 333227 A (FURUKAWA ELECTRIC CO LTD:THE), 17 December 1993 (1993-12-17) abstract	1,9,20, 28
A	PATENT ABSTRACTS OF JAPAN vol. 007, no. 015 (P-169), 21 January 1983 (1983-01-21) & JP 57 169702 A (FURUKAWA DENKI KOGYO KK), 19 October 1982 (1982-10-19) abstract	2,3,5, 10,11, 13,21, 22,24
A	FR 2 538 916 A (THOMSON CSF) 6 July 1984 (1984-07-06) abstract page 6, line 3 - line 19; figure 4 page 7, line 28 - line 31 page 9, line 10 - line 15	1-17, 20-28
A	DE 295 10 705 U (JET LASER SYSTEME GES FUER OBE) 19 October 1995 (1995-10-19) page 11, paragraph 2; figure 2	1-3, 9-11,17, 20-22,28

2

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

ernational application No.
PCT/US 99/20301

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
The figures are not consistent with the description. As they were deemed to be incorrect they were ignored for the search.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US 99 20301

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

The figures are not consistent with the description. As they were deemed to be incorrect they were ignored for the search.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int'l Application No
PCT/US 99/20301

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 4140087 A	09-06-1993	NONE	
JP 04324403 A	13-11-1992	NONE	
DE 3718402 A	22-12-1988	NONE	
JP 05333227 A	17-12-1993	NONE	
JP 57169702 A	19-10-1982	NONE	
FR 2538916 A	06-07-1984	NONE	
DE 29510705 U	19-10-1995	NONE	